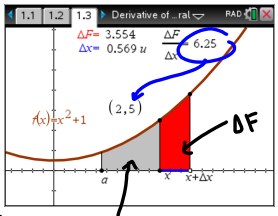
5.4 Fundamental Theorem of Calculus

Run *Derivative of Definite Integral* and answer the questions in the document



(Total Area gray + red) − gray = red

$F(x+\Delta x) - F(x) = \Delta F$

$\lim_{\Delta x \to 0} \frac{\Delta F}{\Delta x} = f(x) = \lim_{\Delta x \to 0} \frac{F(x+\Delta x) - F(x)}{\Delta x}$

$f(x) = F'(x)$

$F(x)$ is an antiderivative of $f(x)$

Nov 13-3:06 PM

State both parts of the Fundamental Theorem of Calculus

I $F(x) = \int_a^x f(t)\,dt$

$F'(x) = f(x)$

$\frac{d}{dx}\int_a^x f(t)\,dt = f(x)$

II $\int_a^b f(x)\,dx = F(b) - F(a)$

where $F(x)$ is an antiderivative of $f(x)$

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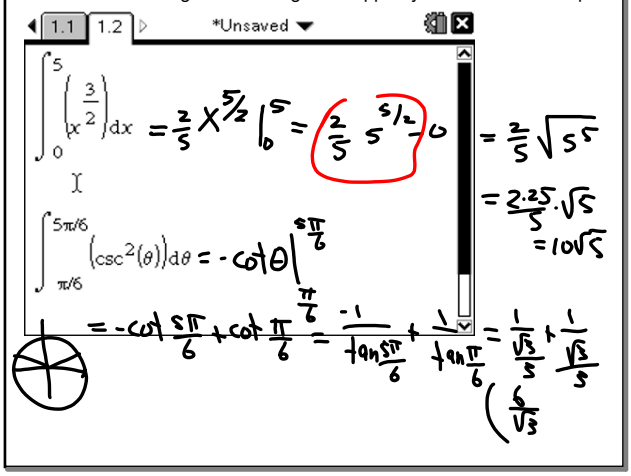
Evaluate the following definite integrals. Support your answer with Nspire



$\int_0^5 \left(\frac{3}{2}x\right)dx = \frac{3}{2}x^{5/2}\Big|_0^5 = \frac{3}{2}5^{5/2} - 0 = \frac{3}{2}\sqrt{5^5}$

$= \frac{3}{2}\cdot 25\sqrt{5} = 10\sqrt{5}$

$\int_{\pi/6}^{5\pi/6} \csc^2(\theta)\,d\theta = -\cot\theta\Big|_{\pi/6}^{5\pi/6}$

$= -\cot\frac{5\pi}{6} + \cot\frac{\pi}{6} = \frac{-1}{\tan\frac{5\pi}{6}} + \frac{1}{\tan\frac{\pi}{6}} = \frac{1}{\frac{\sqrt{3}}{3}} + \frac{1}{\frac{\sqrt{3}}{3}}$

$\left(\frac{3}{\sqrt{3}}\right)$

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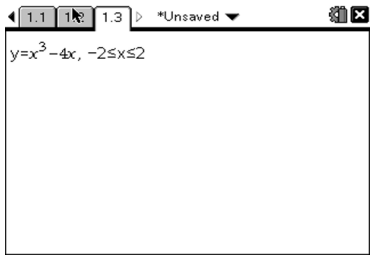
Find the total area of the region between the curve and the x-axis



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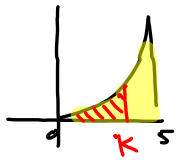
1.1 1.2 5.4 cut area in half

Find the value of k so that the line x=k divides the area under $y=x^2$ from $0 \le x \le 5$ in half.



$\int_0^5 x^2\,dx = \frac{x^3}{3}\Big|_0^5 = \frac{125}{3}$

$\int_0^k x^2\,dx = \frac{x^3}{3}\Big|_0^k = \frac{k^3}{3}$

$\frac{k^3}{3} = \frac{125}{6}$ $k^3 = \frac{125}{2}$ $k = \frac{5}{\sqrt[3]{2}} \approx 3.97$

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Nov 4-5:02 PM